## REMARKS

Objections to the Claims and Specification

Claims 12-19 and the specification were objected to because the claims use the phrase "computer-readable storage medium", which is not found in the specification. In the Office Action, the Examiner suggested amending the claims to use the phrase "computer storage medium" instead of "computer-readable storage medium". With the present amendment, Applicant has adopted the Examiner's suggestion to amend the claims in this manner.

§101 Rejections

Claims 1, 3-6 and 9-11 were rejected under 35 U.S.C. § 101 as not falling within one of the four statutory categories of invention. In particular, it was asserted that in order for a process claim to be statutory it must either be tied to another statutory class or must transform underlying subject matter.

With the present amendment, Applicant has amended claim 1 to indicate that the steps of the process are performed by a processor. As such, Applicant has tied the process to a particular apparatus such that the process of claims 1, 3-6 and 9-11 is statutory.

§ 103 Rejections

### CLAIMS 1, 3-6, & 9-11

Claims 1, 3-5, and 9-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Frey et al. (Publication entitled "Algonquin: Iterating Laplace's Method to Remove Multiple Types of Acoustic Distortion for Robust Speech Recognition," hereinafter Frey) in view Pearson (U.S. Patent No. 6195632). Claim 6 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Frey in view of Pearson and in further view of Ephraim (IEEE Publication, A

Bayesian Estimation Approach for Speech Enhancement Using Hidden Markov Models, hereinafter Ephraim).

Claim 1 provides a method of identifying a clean speech signal from a noisy speech signal. The method includes identifying a set of log-magnitude frequency values for each of a plurality of frames that represent the noisy speech signal. The log-magnitude frequency values of the noisy speech signal are filtered to smooth the log-magnitude frequency values over time to form filtered noisy values. This filtering is performed by applying the log-magnitude frequency values of the noisy speech signal to a Finite Impulse Responsive Filter having a set of filter parameters wherein at least one of the filter parameters of the set of filter parameters differs from another of the filter parameters of the set of filter parameters. Parameters of at least one posterior probability distribution are determined based on the set of filtered noisy values without applying a frequency-based transform to the set of filtered noisy values. The posterior probability distribution provides the probability of a log-magnitude frequency value for a clean speech signal given a filtered noisy value. The parameters of the posterior probability distribution are used to estimate a set of log-magnitude frequency values for a clean speech signal. The log-magnitude values for the clean speech signal are then used to produce an output clean speech signal.

As amended, claim 1 is not shown or suggested in the combination of Frey and Pearson. In particular, neither reference shows or suggests applying log-magnitude frequency values of a noisy speech signal to a Finite Impulse Response Filter to smooth the log-magnitude frequency values over time.

In the Office Action, it was asserted that Pearson discloses a step of filtering log-magnitude frequency values of a noisy speech signal to smooth the log-magnitude frequency values over time at column 6, lines 30-39. Applicants respectfully dispute this assertion.

In the cited section, Pearson is not smoothing log-magnitude frequency values over time. Instead, Pearson is smoothing log-magnitude frequency values over <u>frequency</u>. In other words, the smoothing applied by Pearson is a frequency-based transform that alters the magnitude of some frequencies more than others for a single frame of time.

The fact that Pearson is smoothing over frequency can be seen in column 6, lines 35-37 where an implementation of the smoothing function is said involve "3, 5 or 7 point windows in the log magnitude spectrum." A log-magnitude spectrum is a set of log-magnitude values for a distribution of frequencies (a spectrum). Thus, the points are distributed across frequencies and not across time. As such, when Pearson refers to replacing a low value with the "average of two surrounding higher points", he is referring to replacing a log-magnitude value for one frequency with the average of the log-magnitude values of two neighboring frequencies in a single frame of time.

This interpretation is further supported by column 5, lines 50-67 and column 6, lines 8-9 of Pearson. In column 5, Pearson discusses the definition of an arc-length based on data points. In column 6, lines 8-9, Pearson indicates that the arc-length for log spectral magnitude is determined "versus mel frequency". Thus, the data points for determining arc-length for log spectral magnitude have one parameter that represents a log-magnitude value and another parameter that represents a "mel frequency". In column 6, lines 30-39, it is this type of data point that is referred to in the phrase "3, 5 or 7 point windows in the log magnitude spectrum."

In addition, Pearson indicates that the smoothing is to eliminate the "effects of harmonics or sharp zeros". (Column 6, line 32) Harmonics and sharp zeros appear in the log-magnitude spectrum as large changes in the log-magnitude values between neighboring frequencies. As such, the most direct way to eliminate the "effects of harmonics or sharp zeros" is to smooth the log-magnitude values within the frequency domain. This would reduce the differences in the log-magnitude values between neighboring frequencies thereby eliminating the "effects of harmonics or sharp zeros".

Since Pearson does not smooth log-magnitude frequency values over time but instead performs frequency-based smoothing, the combination of Frey and Pearson does not show or suggest the invention of claim 1, which requires that log-magnitude frequency values be filtered to smooth the values over time. As such, claim 1 and claims 3-6 and 9-11, which depend therefrom, are patentable over the combination of Frey and Pearson.

## CLAIMS 12-19

Claims 12-16, and 18-19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Frey in view of Pearson. Claim 17 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Frey in view of Pearson and in further view of Ephraim.

Independent claim 12 provides a computer storage medium storing computer-executable instructions for performing steps. The steps include applying values that represent frames of a noisy speech signal to a Finite Impulse Response filter having a set of filter parameters wherein one of the filter parameters of the set of filter parameters differs from another filter parameter of the set of filter parameters to provide time-based filtering and to produce filtered values representing noisy speech. A posterior probability is determined based on the filtered values, wherein a frequency-based transform is not applied before the filtered values are used to determine the posterior probability. The posterior probability provides the probability of frequency values for a clean speech signal given the filtered values. The posterior probability is used to estimate a frame of a clean speech signal and the frame of the clean speech signal is used to produce an output clean speech signal.

The combination of Pearson and Frey does not show or suggest the invention of claim 12 because neither reference shows or suggests time-based filtering of frames of noisy speech using a Finite Impulse Response Filter with one of the filter parameters differing from another of the filter parameters.

As noted above, Column 6, lines 30-39 of Pearson does not show time-based filtering but instead shows frequency-based smoothing that eliminates the effects of harmonic and sharp zeros by replacing low log-magnitude values at one frequency with higher log-magnitude values at neighboring frequencies within the frequency domain and not the temporal domain. As such, the combination of Pearson and Frey does not show or suggest the invention of claim 12 or claims 13-19, which depend therefrom.

## CONCLUSION

Based on the above remarks, claims 1, 3-6 and 9-19 are in form for allowance. Reconsideration and allowance of the claims is respectfully requested.

The Director is authorized to charge any fee deficiency required by this paper or credit any overpayment to Deposit Account No. 23-1123.

Respectfully submitted,

WESTMAN, CHAMPLIN & KELLY, P.A.

By: _____

Theodore M. Magee, Reg. No. 39,758
900 Second Avenue South, Suite 1400
Minneapolis, Minnesota 55402-3319
Phone: (612) 334-3222 Fax: (612) 334-3312

TMM:kjl